

UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
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FESCR 8201

STUDENT OUTLINE

REBUILD BLOWERS

LEARNING OBJECTIVES:

1. Terminal Learning Objective: Provided with faulty blowers, required tools, replacement parts, shop supplies, cleaning materials, and references, rebuild the blowers to a serviceable condition, per the references. (3524.02.03)
2. Enabling Learning Objectives: Provided with a faulty blower, required tools, replacement parts, shop supplies, cleaning materials, and TM 9-2320-297-34, per the reference: (3524.02.03a)
 - a. Disassemble the blower. (3524.02.03b)
 - b. Inspect the blower components for serviceability. (3524.02.03c)
 - c. Replace the unserviceable components. (3524.02.03d)
 - d. Assemble the blower. (3524.02.03e)

OUTLINE

1. DESIGN CHARACTERISTICS AND PRINCIPLES OF OPERATION OF THE 8V92TA DETROIT DIESEL ENGINE

a. In the scavenging process employed in some engines, such as the 8V92TA, the blower forces a continuous charge of air into the cylinders. This air thoroughly sweeps out all of the burned gases through the exhaust ports and helps cool the internal engine parts, particularly the exhaust valves. Therefore, at the beginning of the compression stroke, each cylinder is filled with fresh, clean air, which provides for efficient combustion.

b. Air entering the blower from the air cleaner, and on some engines through a turbocharger, is picked up by the blower rotor lobes and carried to the discharge side of the blower. The continuous discharge of fresh air from the blower enters the air chamber of the cylinder block and sweeps through the intake ports in the cylinder liners.

c. The angle of the ports in the cylinder liners creates a uniform swirling motion to the intake air as it enters the cylinders. This motion persists throughout the compression stroke and facilitates scavenging and combustion.

d. To put it simply, we could say that the blower, designed especially for efficient diesel engine operation, supplies the fresh air needed for combustion and scavenging. You could also say that its operation is similar to that of a gear-type oil pump, in that two, hollow, three-lobe rotors revolve with very close clearances in a housing bolted to the top deck of the cylinder block, between the two banks of cylinders. Also, the helical (spiral) design of the rotor lobes provides continuous, uniform displacement of air.

e. Currently there are two basic types of blowers being used: the regular type and the OTM (optional turbocharger mounting) type.

(1) The regular-type blower has six mounting holes in the top of the blower housing and has regular end plates. It is used on engines that do not employ a turbocharger.

(2) The OTM-type blower has additional outboard holes for mounting the turbocharger adapter. One of the end plates includes two oil drain holes with seal rings for the turbocharger return oil drain back. This blower is used on turbocharged engines that require a larger volume of air for scavenging and combustion. The one we use for training is the OTM-type.

2. REPAIR PROCEDURES FOR THE BLOWER

a. Disassemble the Blower

(1) Follow along in the manual as we discuss each step and it will help you when it comes time for the performance test. Also, throughout these instructions, you will be directed to apply torque in foot pounds just as it states in your technical manual. However, you know you must convert foot-pounds to inch-pounds when dealing with low torque specifications. That will be your responsibility. It is done in the interest of accuracy; foot-pound torque wrenches are not accurate at extremely low readings.

(2) Remove the eight shipping bolts mounted to the outside of the end plates.

(3) Place the special rubber tool, which is just a piece of tire, between the gears and remove the cap screws and sleeve from each gear. The manual tells you to use a clean shop cloth between the gears, which is ok. However, you will find that the gears will turn your shop cloth into a shop rag.

(4) Pull the two gears. To do this, we use the two gear pulling tools like you see here. Install one on each gear, using two bolts on the left gear and three bolts on the right gear. Before removing the two gears, place the piece of rubber between the two gears again and break the torque on the fuel pump drive capscrew located at the front of the blower. Remove the two gears by turning the two gear pulling tool screws uniformly clockwise and withdraw the gears from the rotor shafts. Tag the gears right and left and remove the gear pulling tool from the gears.

(5) Remove and tag the shims and spacers from the rotor shaft. Remove and tag the rear bearing retainers by removing the six screws. Once you have that done, repeat the procedure for the front bearing retainers. If there are no questions, you may now remove the gears and bearing retainers from your blower.

(6) Remove the rear end plate, loosen the two screws in the front end plate, three complete turns or until the heads of the screws are flush with the housing. Remove the two screws from the rear end plate. Align the holes of the two gear pulling tools with the tapped holes in the rear end plate. Secure the gear pulling tools by evenly installing three ¼ inch capscrews around each one. Turn both gear pulling tool screws clockwise and remove the rear end plate. Remove the gear pulling tools from the end plate.

(7) Remove the front end plate, tag the end plate left and right; remove the two screws and the end plate. If there are no questions, remove the two end plates from your blower.

(8) Remove the rotors, pull them slowly and evenly from the housing. Handle the rotors with care to avoid damage. Do not force the rotors out of the housing. It is very important that the rotors be marked for proper reinstallation. Follow the marking procedure in the manual carefully. Remove the rotors from the housing of your blower.

(9) Remove the oil seal ring carrier, position one lobe of the rotor in a soft jawed vise and tighten the vise just enough to secure the rotor. Using snap ring pliers, remove the oil seal ring from the oil seal ring carrier. To avoid damaging the oil seal ring, do not twist or spread it more than to remove it. Once the oil seal is out of the way, we install the carrier remover adapter in the groove of the oil seal ring carrier and secure the gear pulling tool to the remover adapter with two cap screws. Using the gear pulling tool, remove the oil seal ring carrier. Remove the other three oil seal carriers, using the same procedures. You may now remove the oil seal rings and carriers from the rotor shafts.

(10) If the blower has the new double-lipped oil seals in place of the three-piece oil seal ring, support the outer face of the end plate on wooden blocks, on a press. Using the oil seal remover and installer, press the bearing and oil seal out of the end plate. If the blower does not have the double-lipped oil seals, press out the bearing and collar.

b. Inspect Blower Components

(1) First, you must clean all the components with clean fuel oil and dry them with compressed air.

(2) Examine the bearings for any indications of corrosion or pitting. Lubricate each ball bearing with light engine oil. While holding the bearing inner race from turning, revolve the outer race slowly by hand and check for rough spots.

(3) If the oil seal rings, carriers, and collars are to be reused, check them for wear or scoring. They must be replaced if worn excessively. The current oil

seal rings are chrome flashed and the carriers are liquid nitrated. When replacement of an oil seal ring or carrier is necessary, both parts must be replaced together. However, you will find that if you get the rebuild kit for the blower, it will have the double-lipped seals in it and they can be used to replace the oil seal ring, carrier, and collar.

(4) The next items we will inspect are the rotor lobes, especially the sealing ribs, for burrs or scoring. The rotors must be smooth for satisfactory operation of the blower. If the rotors are slightly scored or burred, they can be cleaned up with emery cloth. Examine the rotor shaft serrations for wear burrs or peening. Also, inspect the bearing and oil seal contact surfaces of the shafts for wearing and scoring.

(5) Inspect the inside surface of the blower housing for burrs or scoring. The inside surface must be smooth for efficient operation of the blower. If the inside surface of the housing is slightly scored or burred, it can be cleaned up with emery cloth. Check the finished ends of the blower housing for flatness or burrs.

(6) The end plates must set flat against the blower housing. The finished inside face of each end plate must be smooth and flat. If the finished face is slightly scored or burred, it can be cleaned up with emery cloth. However, be careful not to remove metal at the joint face between the end plates and the housing. If you do, air or oil leaks could develop after assembly.

(7) Examine the serrations in the blower timing gears for wear or peening. Also, check the gear teeth for wear, chipping or other damage. If the gears are worn or damaged sufficiently to require replacement, both gears must be replaced as a set.

c. Assemble the Blower

(1) If the oil seal rings and carriers are to be reused, support the rotor with wooden blocks on a press. Lubricate the oil seal ring carrier with clean engine oil and with the chamfered inside diameter facing the rotors, press the carrier down tight against the rotor with the oil seal ring carrier installer. The other three carriers are installed using the same procedures. Install the oil seal ring on the carrier, being careful not to spread the seal ring more than necessary to get it into the groove of the carrier. If there are no questions, install the four oil seal ring carriers and oil seal rings on your rotor shafts.

(2) **CAUTION!** If the double-lipped oil seals are used, they must be installed dry. Do not apply oil to the inside or outside diameter of the seal. This seal is coated with Teflon and the use of oil will damage the Teflon coating.

(a) Install a new oil seal spacer on the rotor shaft using the installation tool.

1 Press it on the rotor shaft until the shoulder of the installation tool or the spacer contacts the rotor.

2 Install the remaining three spacers following the same procedures.

- (b) Remove the plastic seal protectors and set them aside for use later.
- (c) Use the seal installation tool to install the double-lipped oil seals.
- (d) Install the double-lipped oil seal with the numbered side towards the installation tool.
- (e) Install the double-lipped oil seal into the rear end plate until the installation tool contacts the rear end plate.
- (f) Install the remaining three seals the same way.
- (g) If there are no questions, install the double-lipped oil seals.

(3) After you have the oil seal rings and carriers installed, the next thing is to install the oil seal collars into the end plates. To do this, support the end plate with wooden blocks on a press. Lubricate the outside diameter of the oil seal collar with clean engine oil and with the chamfered outside diameter facing the end plate. It should be .002 to .008 inches below the face of the rear end plate. If there are no questions, install the oil seal collars into the end plates.

(4) Once the oil seal collars are in place, we are ready to install the rotors in the front end plate. Support the end plate on two wooden blocks with the flat side facing up and the installation mark "top" on the end plate facing to your right. Lubricate the oil seal rings on both ends of the rotors with clean engine oil. Install the rotors in their tagged shaft hole. The installation marks must line up during installation. Work the rotors into position until they contact the front end plate, being careful not to damage the oil seal rings.

(a) **CAUTION!** If double-lipped oil seals are used, installation of the rotors without using the plastic seal protectors could damage the double-lipped seals.

(b) **CAUTION!** To prevent damage to the double-lipped seal, do not apply oil to the seal or rotor shaft.

(c) Reinstall the plastic protectors into the double-lipped oil seals, tapered edge facing out. Install the rotor into the shaft hole until the rotor contacts the front end plate.

(d) If there are no questions, install the rotors into the front end plate.

(5) The next thing we want to do is to lower the blower housing down over the rotors. Make sure the topside of the housing is facing the same way as the topside of the end plate. Aline the dowel pin holes in the housing with the dowel pins in the front end plate and push the housing until it is seated against the front end plate. If necessary, tap the blower housing with a soft-faced hammer. Firmly hold the front end plate and housing together and carefully set the blower down on the workbench, with the top facing up. Then, secure the end plate to the housing by

installing the two screws and torque them 5 to 10 foot-pounds. Do you have any questions? You may now install the housing to the front end plate.

(6) Install the rear end plate. Stand the blower up on the two wooden blocks. Center the oil seal rings and install the end plate so the flat, smooth surface faces the rotors. Make sure the installation marks are aligned, install the two screws, and torque to 5 to 10 foot pounds. You can now install your end plate to the blower housing.

(7) Install the bearings. Lubricate the bearings with clean engine oil and install them, with the numbered end up, into the rear end plate. Make sure you put them in their tagged location. Use the installation tool and tap the bearings in until they are fully seated. Turn the blower over and install the bearings into the front end plate, with the shoulder side up. Do you have any questions? If not, install your bearings in their tagged location.

(8) Before we assemble anything more, we need to check the rotor-to-end plate clearances. The feeler gauge is placed between the rotor and end plate at both ends. The clearance at point "a" is .007 inch and at point "b" .014 inch. If the clearances are below the minimum, tap the bearings, using a seal ring installation tool, and recheck the clearances. Repeat the procedure until the proper clearances are obtained. Are there any questions? If not, check the rotor end clearances on your blower.

(9) Now that we all have the correct rotor end clearances, we need to install the bearing retainers. Torque the screws to 2 to 9 foot-pounds. If there are no questions, install the retainers.

(10) Position the blower on the workbench, with the rear end plate towards you. Rotate the rotors and bring the flat spots in the rotor shaft splines into alignment, facing to the left. We are ready to install the timing gears.

(a) Install the spacers and shims in their tagged location. Then, lubricate the splines on the shafts of the rotors with clean engine oil and install the gears in their tagged location. Make sure their teeth are meshed and the flat spots inside the gears align with the flat spots on the rotor shafts.

(b) Thread the capscrews with spacers into their tagged locations, place the rubber between the gears, and tighten the capscrews evenly until the gears are against the spacers and shims. Evenly torque the cap screws to 100 to 110 foot-pounds. Do you have any questions? Install the timing gears on your blower.

(11) The last thing we will do to the blower is check the rotor clearances. However, before we do that we need to install four 5/16-18 x 1-7/8 cap screws with flat washers in each of the front and rear end plates and torque them to 13 to 17 foot-pounds. This will hold the end plates against the blower housing while you make the clearance checks. Turn the blower on its side and support it with wooden blocks. We are now ready to check the clearances and make adjustments, if needed.

(a) Recheck the rotor end clearances between the lobes of the rotor and end plates. There should not be any questions on how to check rotor end

clearance; you have already done it once. So, at this time, recheck your rotor end clearances.

(b) To increase or decrease clearance between the rotors, you must add or remove shims from behind the gears. For example, placing a .003 inch shim behind a gear will rotate the rotor .001 inch. The shims come in different thickness. Also, you must make the rotor-to-rotor measurements one inch from each end and at the center of the blower.

(c) We are going to check the clearances between the rotors at points "c" and "d" and the rotor housing at point's "e" and "f". Don't forget that you have to check these clearances at both ends and in the center. You will have to rotate the rotors to aline the lobes with each of the points to be checked. Refer to the technical manual for the minimum clearance at each point. Do you have any questions on making these clearance checks? If you have a problem while making the checks, raise your hand. One of the instructors will be glad to help you out.

(d) The next clearance checks are made the same way. The difference is, we have rotated the rotors 180 degrees and are checking the clearances of the other rotor. Are there any questions? Make these clearance checks on your blower.

(e) Remember, to adjust the rotor clearance, you must add or remove shims from behind the gears. At this time I want you to remove the eight 5/16-18 x 1-7/8 cap screws we used to hold the two end plates.

REFERENCE

TM 9-2320-297-34